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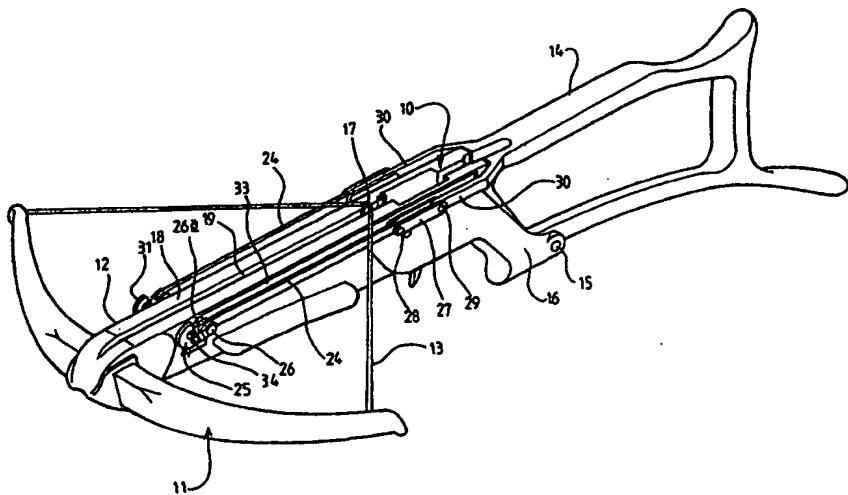


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(54) Title: CROSSBOWS



(57) Abstract

A crossbow comprises a stock (10) including a fore-end portion (12) having a guide surface for a bolt, and a butt portion (14) pivotally connected thereto, and a cocking means which includes a linkage (24, 27) connected between said butt portion and a hook member (25) which engages the bow-string (13) to draw it rearwardly to engage with a releasable catch (17) for holding the bow-string in its cocked position. The hook member (25) is pivotally connected to said linkage and includes guide elements (26a, 34) which engage a guide track (33) extending along the fore-end portion so that the hook member (25) is maintained in a substantially unvarying orientation relative to the bow-string (13) as it is drawn towards the releasable catch (17). The hook member comprises two transversely spaced hooks (31) each of which includes a roller (35) whereby the bow-string is engaged, and the guide track (33) includes a forward portion (33a) which extends away from the path of the bolt when fired, so to retract the hook member out of the path of the bolt and bow-string before the bolt is fired.

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Title: Crossbows**Description of Invention**

This invention relates to crossbows of the kind comprising a stock which includes a butt portion and a fore-end portion having a guide surface for a bolt, a resiliently flexible bow piece, usually called a bow prod in the art, which is supported by the fore-end portion of the stock, a bow-string having opposite ends thereof attached to corresponding ends of the bow prod, and a releasable catch for holding the bow-string at a cocked position spaced rearwardly from the bow prod when the bow is in a cocked condition ready for use.

When the bow-string lies adjacent to the bow prod, in what is called herein the rest position of the bow-string, there is little or no tension in the bow-string and the prod is substantially unstressed. When the bow is in the cocked condition, the bow prod is bent into a stressed condition and there is a high tension in the bow-string. Crossbows may be cocked by grasping the bow-string with the hands and drawing the bow-string along the fore-end portion to the catch. Because of the high tension which has to be established in the bow-string, this is a difficult operation and, in some cases, is impossible for users who lack considerable physical strength. Furthermore, as the surface area of the bow-string over which the user can exert the necessary pressure is severely limited by the diameter of the bow-string, some degree of pain can be inflicted on the user.

To enable crossbows to be cocked more easily, separate tools have been provided for use with certain crossbows, which tools have relatively movable parts engageable respectively with the stock and with the bow-string. These tools can then be manipulated to move the bow-string along the stock to the catch.

However, the use of a separate tool for cocking a crossbow is inherently inconvenient, as the tool must be carried in addition to the crossbow and bolts.

GB 1553387 describes a crossbow which eliminates such disadvantages and in which the butt portion is pivotally connected with the fore-end portion for movement relative thereto about a pivot axis so that the butt portion can be used as a lever, and a cocking means is provided which includes a linkage connected with said butt portion, and a hook member to engage the bow-string, whereby pivotal movement of said butt-portion relative to said fore-end portion in one direction causes the bow-string to be engaged by said hook member and drawn along the fore-end portion towards the butt portion and into engagement with said releasable catch which then holds the bow-string in the cocked position.

The object of this invention is to provide further improvements in such a crossbow.

According to a first aspect of the invention, we provide A crossbow of the kind comprising a stock which includes a fore-end portion having a guide surface for a bolt, and a butt portion pivotally connected with the fore-end portion for movement relative thereto about a pivot axis so that the butt portion can be used as a lever; a resiliently flexible bow prod which is supported by the fore-end portion of the stock; a bow-string having opposite ends thereof attached to corresponding ends of the bow prod; a releasable catch for holding the bow-string at a cocked position spaced rearwardly from the bow prod when the bow is in a cocked condition ready for use; and a cocking means which includes a linkage connected with said butt portion and a hook member to engage the bow-string, whereby pivotal movement of said butt-portion relative to said fore-end portion in one direction causes the bow-string to be drawn along the fore-end portion towards the butt and into engagement with said releasable catch which then holds the bow-string in the cocked position; characterised in that the hook member is pivotally connected to said linkage and includes guide means which co-operate with a guide track extending along the fore-end portion whereby the hook member is maintained in a substantially

unvarying orientation relative to the bow-string as it is drawn towards the releasable catch.

In this way angular movement of the linkage is not transmitted to the hook member in a way which can otherwise tend to pull the bow-string away from its intended position of engagement with the catch in a direction perpendicular to the bolt guide surface, which in turn can alter the flight path of the bolt when released.

The hook member preferably comprises two transversely spaced hook elements arranged laterally off-set relative to the length of the bolt guide surface, on either side thereof, and each coupled to a respective draw link of the linkage whereby the hook member is drawn towards the catch during cocking action.

The guide means of said hook member preferably includes roller elements spaced longitudinally of said guide track.

Preferably, the hook element includes rollers which are arranged to engage the bow-string and allow the latter to become centred relative to the catch despite possible imbalance in the tensioning of opposite sides of the bow prod. Such rollers, which are preferably of concave profile, may be arranged for rotation about axes that are perpendicular to the length of the bow-string.

These features of the invention may be applied to crossbows using bow prods of either the compound type or the re-curved type. The former require relatively longer movement to achieve the cocking action because of the mechanical advantage provided by the pulley system for drawing the bow-string back but, because of the difference in bow prod shapes, when released the bow-string does not travel as far in the forward direction as in the latter type. These differences mean that it is necessary to provide a longer range of travel for the action of cocking a crossbow of the compound type, and for bows of the re-curved type to make provision for moving the hook member out of the path of movement of the bow-string in the vicinity of its rest position.

For the first purpose, in accordance with a further feature of the invention, in a compound bow the linkage includes, in addition to the draw link to which the hook member is pivotally coupled, a swing link connected between the butt portion and the draw link. This arrangement allows the draw link to drop beneath the bow-string during the return stroke of the linkage. Whilst this can be achieved conveniently for the shorter movement required for re-curved bow prods by adopting a draw link of cranked form as shown in GB1553387, the cranked draw link arrangement is less suitable for compound bows because of the greater offset needed as a result of the longer stroke.

Instead of using rigid links as described above, in accordance with a further feature of the invention, the linkage may comprise flexible tension elements connected between the butt portion and the hook member. Such flexible elements may comprise either cables or chains, in particular a sprocket chain, in either case guided over rollers or sprocket wheels as appropriate.

For the purpose of ensuring that the hook member is retracted from the path of the bow-string, at least where a re-curved bow prod is provided, the guide track may include a forward end portion which extends away from said bolt guide surface.

The invention also resides in a crossbow stock having such features.

These and other features of the invention will now be described, by way of example, with reference to the accompanying drawings wherein:

FIGURE 1 shows a perspective view of a first embodiment of crossbow incorporating a bow prod of the re-curved type and a stock having a cocking mechanism in accordance with the invention,

FIGURE 2 shows a plan view of the stock of the crossbow illustrated in Figure 1,

FIGURE 3 shows a side elevation of the stock of Figure 2 with the butt portion thereof in a position approximately half way along a permitted range of

pivoting movement relative to the fore-end portion of the stock during the cocking action,

FIGURE 4 shows a view similar to that of Figure 4 but during the return movement of the butt portion after the cocking action, and

FIGURE 5 shows a side elevation similar to Figure 3 of a modification of the invention in which a flexible linkage replaces the rigid linkage of Figures 1 to 3.

The crossbow shown in Figure 1 comprises a stock 10, a resiliently flexible bow prod 11 of the re-curved type which is fitted removably at the forward end of stock in known manner. The stock 10 comprises a fore-end portion 12 and a butt-portion 14 which is connected with the fore-end portion 12 by a pivot pin 15 for pivoting movement relative thereto about a transverse axis which is located towards the bottom end of a downwardly extending hand-grip member 16 formed at the rear of the fore-end portion. A bow-string 13 has opposite ends thereof attached to corresponding ends of the bow prod 11.

In the cocked position of the crossbow, which is illustrated in figure 1, the bow prod 11 is bent and the bow-string 13 is held by a catch 17 at a position on the stock spaced rearwardly from the bow prod. The fore-end portion 12 of the stock has a flat upper guide surface 18, in which there is formed a guideway 19 along which a bolt can be projected by the bow-string when the latter is released from the catch by the action of a trigger. Adjacent to the forward end of the fore-end portion 12, there is a formation for receiving the bow prod 11, this formation being in the illustrated embodiment an aperture 20 of shape corresponding to the cross section of a central section of the bow prod 11.

The catch 17 is mounted in the fore-end portion 12 at a position nearer to the rear end thereof than to the forward end thereof. The catch is mainly disposed within a slot which extends downwardly from the upper surface 18 of

the fore-end portion and is connected to the fore-end portion for pivoting movement relative thereto by a pivot pin 21 which extends parallel to the pivot pin 15.

When the bow is cocked, the catch 17 occupies the position illustrated in figure 1 and projects upwardly from the upper surface 18 of the fore-end portion. The catch is held in this cocked position by a trigger 22 pivotally mounted on a pivot pin 23 parallel to the pivot pin 15.

The stock 10 includes a cocking mechanism for drawing the bow-string 13 from the rest position (as shown in chain-dot lines in Figure 2) in which it extends directly between the ends of the bow prod 11 to the cocked position in which, as illustrated in Figure 1, it is tensioned and held by the catch 17. This mechanism, as hereinafter described, is operated by pivotal movement of the butt-portion 14 of the stock 10 relative to the fore-end portion 12, and includes a pair of elongate draw links 24 arranged parallel to one another to extend along opposite sides of the fore-end portion 12.

At their forward ends, the draw links 24 are pivotally coupled to a hook member 25 by means of a pivot pins 26, and at their rearward ends to one end of a respective pair of swing links 27 by means of a pivot pin 28. Each swing link 27 is pivotally connected at its opposite end by means of a pivot pin 29 to a respective one of a pair of forwardly extending arms 30 carried by the butt-portion 14 at a position spaced from the pivot pin 15 whereby it is connected to the fore-end portion 12.

Pivotal movement of the butt-portion 14 downwardly about pivot pin 15 causes the draw links 24 to pull the hook member 25 rearwardly and thereby draw the bow-string towards the catch 17 so as to cock the crossbow. During such cocking action, the pivot pins 29 at the forward ends of the arms 30 move through an arc indicated at "A" in Figure 3 and above the level of the upper surface 18 of the fore-end portion 12, and the swing links 27 and draw links 24

can maintain a straight line configuration because they are at all points along their length disposed rearwardly of the bow-string.

However, once the bow-string is engaged behind the catch 17, when the butt-portion 14 is returned to the firing position as shown in Figure 1, and the hook member 25 is returned to its starting position, the bow-string would obstruct the return movement of a single rigid link of the length of the draw link 24 and swing link 27 in combination, and the bow-string would be displaced from the catch. The provision of the swing links 27 avoids this problem by allowing the draw links 24 to drop beneath the bow-string as shown in Figure 4.

The hook member 25 comprises a pair of transversely spaced hook elements 31 which project above the level of the upper surface 18 of the fore-end portion 12 so as to engage the bow-string 13 at laterally spaced positions on either side of the fore-end portion 12. Each hook element 31 includes a clevis 32 which carries a respective one of the pivot pins 26. Each pivot pin 26 extends laterally beyond the clevis element 32 towards the fore-end portion 12 and terminates in a headed portion 26a which is located and guided within a longitudinal track 33 of generally squared C-shape in section which extends along the respective side of the fore-end portion. Each hook element 31 also carries a laterally projecting headed pin 34, the head of which is located and guided within the respective track 33 at a position spaced forwardly from the pin 26. The headed pins 26 and 34 fit closely within the tracks and thereby serve to hold the hook member 25 in an unvarying orientation while in engagement with the bow-string during its rearward movement as the crossbow is cocked so as to avoid any tendency to draw the bow-string down towards the upper surface 18.

As can be seen from Figure 3, when the bow-string 13 is in its rest position it is disposed near to the hook member 25 in its starting position, and the hook member could therefore obstruct the firing action when the bow-string is released by the trigger.

However, to prevent the hook member, when returned to the starting position, from interfering with the firing action by catching the bow-string, the tracks 33 are formed with downwardly inclined forward extensions 33a, whereby the headed pins 34 carried by the hook elements 31 enter the end portions 33a of the tracks and pivot the hook member 25 downwardly so that the hook elements 31 are then clear of the path of movement of the bow-string where it overshoots its rest position as the bolt is fired.

Each hook element 31 additionally carries a concave roller 35 arranged for rotation about a vertical axis and the bow-string is engaged by such rollers. This arrangement ensures that the bow-string is self-centring relative to the hook members in the event that there is any slight imbalance in the position of the bow prod.

Instead of employing pivoted links 24 and 27 as described above, as shown in Figure 5 it is alternatively possible to provide a flexible linkage such as a cable 36 which passes under a guide roller 37 carried by the fore-end portion, with spring (or other) tensioning means 38 acting, for example, between the hook member 25 and anchorage points at the forward end of the fore-end portion, to draw the hook member back to the starting position as the butt-portion is returned to its starting position. Instead of a cable 36 and associated roller 37 it would be possible to use a sprocket chain and sprocket wheel.

Where the stock is intended to be used for a bow of the compound type which employs a pulley system to stress the bow prod, the shape of the bow prod is such that in the rest position the bow-string is not disposed so near to the forward end of the fore-end portion of the stock as illustrated in Figure 1, and in consequence it may not be necessary to provide the downwardly inclined end portions 33a of the tracks 33 in such a case.

In the present specification "comprise" means "includes or consists of" and "comprising" means "including or consisting of".

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function or for attaining the disclosed result, as appropriate, may be utilised, separately, or in any combination of such features, for realising the invention in diverse forms thereof.

CLAIMS

1. A crossbow of the kind comprising a stock which includes a fore-end portion having a guide surface for a bolt, and a butt portion pivotally connected with the fore-end portion for movement relative thereto about a pivot axis so that the butt portion can be used as a lever; a resiliently flexible bow prod which is supported by the fore-end portion of the stock; a bow-string having opposite ends thereof attached to corresponding ends of the bow prod; a releasable catch for holding the bow-string at a cocked position spaced rearwardly from the bow prod when the bow is in a cocked condition ready for use; and a cocking means which includes a linkage connected with said butt portion and a hook member to engage the bow-string, whereby pivotal movement of said butt-portion relative to said fore-end portion in one direction causes the bow-string to be drawn along the fore-end portion towards the butt and into engagement with said releasable catch which then holds the bow-string in the cocked position; characterised in that the hook member is pivotally connected to said linkage and includes guide means which co-operate with a guide track extending along the fore-end portion whereby the hook member is maintained in a substantially unvarying orientation relative to the bow-string as it is drawn towards the releasable catch.

2. A crossbow according to Claim 1 wherein the hook member comprises two transversely spaced hook elements arranged laterally off-set relative to the length of the bolt guide surface, on either side thereof, and each coupled to a respective draw link of the linkage whereby the hook member is drawn towards the catch during cocking action.

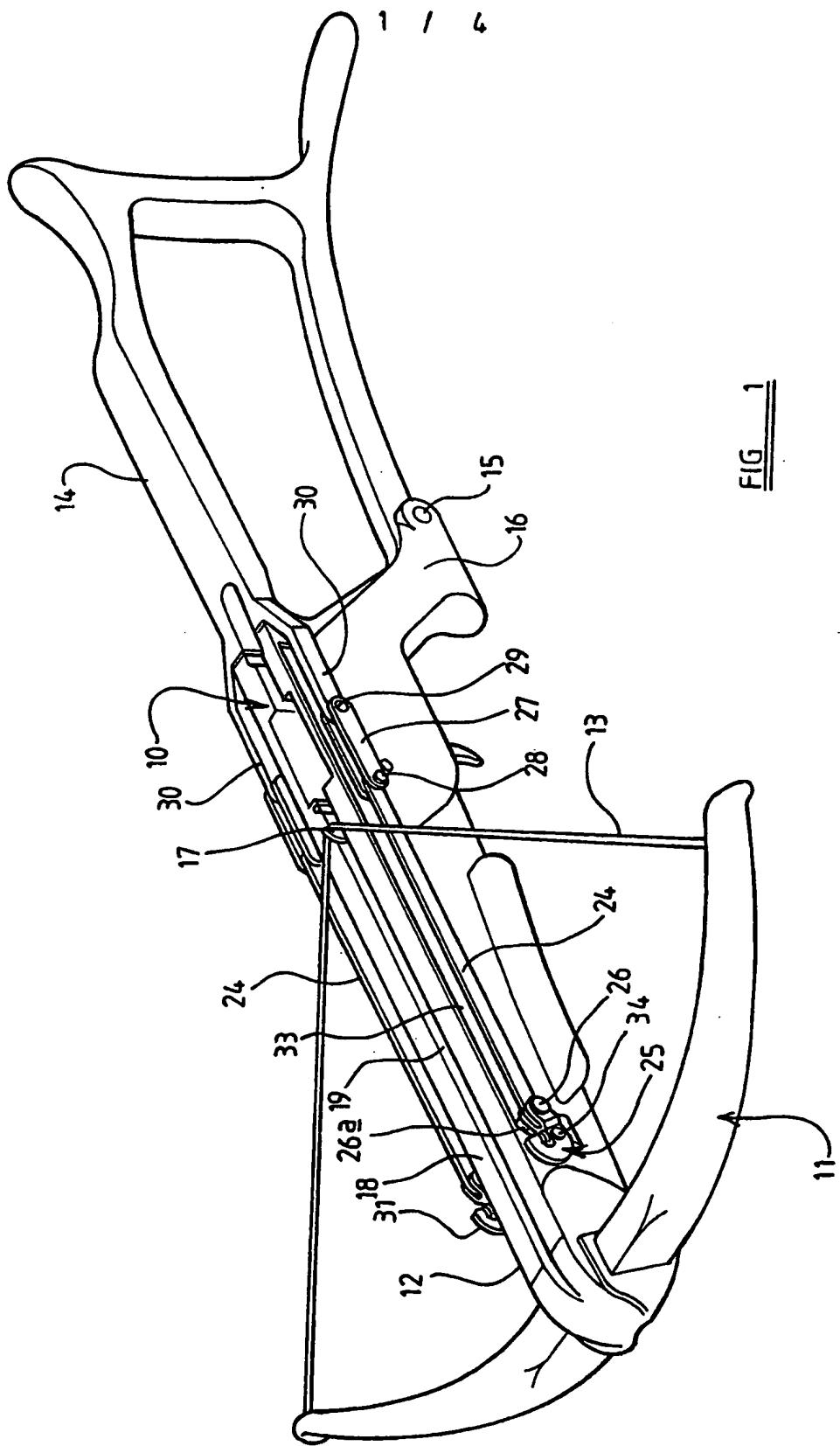
3. A crossbow according to Claim 2 wherein the hook elements include rollers arranged for rotation about axes that are perpendicular to the length of the bow-string.
4. A crossbow according to Claim 3 wherein the hook element rollers are of concave profile.
5. A crossbow according to any one of claims 1 to 4 wherein the guide means of said hook member includes roller elements spaced longitudinally of said guide track.
6. A crossbow according to any one of claims 1 to 5 wherein the guide track includes a forward end portion which extends away from said bolt guide surface for the purpose of ensuring that the hook member is retracted from the path of the bow-string.
7. A crossbow according to Claim 2 wherein the linkage includes, in addition to the draw link to which the hook member is pivotally coupled, a swing link connected between the butt portion and the draw link, whereby the draw link is allowed to drop beneath the bow-string during the return stroke of the linkage.
8. A crossbow according to any one of claims 1 to 5 wherein the linkage comprises flexible tension elements connected between the butt portion and the hook member.
9. A crossbow according to Claim 9 wherein said flexible elements comprise cables guided over rollers.

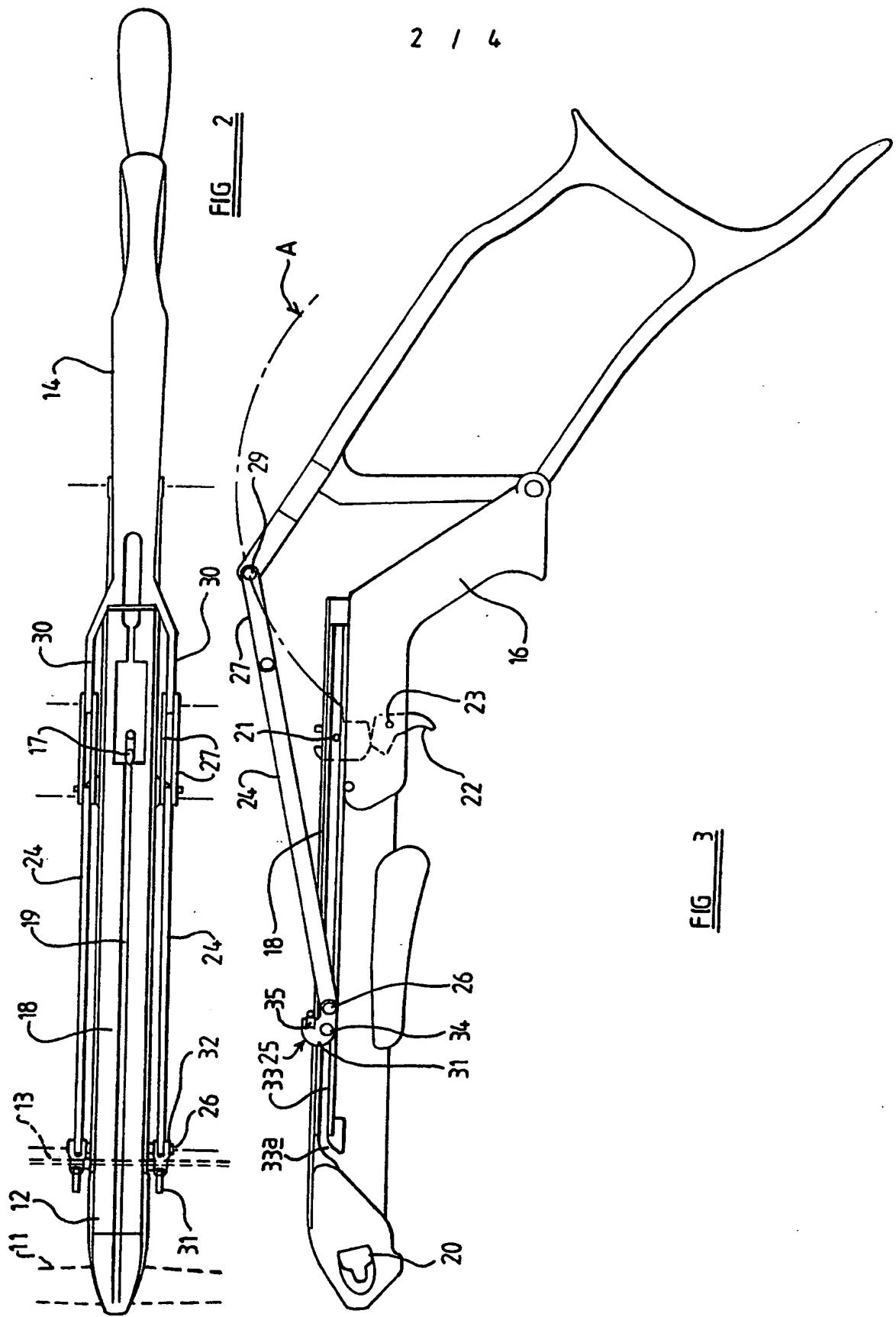
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10. A crossbow according to Claim 8 wherein said flexible elements comprise chains, in particular a sprocket chain, guided over sprocket wheels.
11. A crossbow according to any one of the preceding claims wherein the bow prod is of the re-curved type.
12. A crossbow according to any one of claims 1 to 10 wherein the bow prod is of the compound type.
13. A crossbow stock of the kind which includes a fore-end portion having a guide surface for a bolt, and a butt portion pivotally connected with the fore-end portion for movement relative thereto about a pivot axis so that the butt portion can be used as a lever mounting means arranged on the fore-end portion for receiving a resiliently flexible bow prod with a bow-string having opposite ends thereof attached to corresponding ends of the bow prod; a releasable catch for holding the bow-string at a cocked position spaced rearwardly from the bow prod when the bow is in a cocked condition ready for use; and a cocking means which includes a linkage connected with said butt portion and a hook member to engage the bow-string, whereby pivotal movement of said butt-portion relative to said fore-end portion in one direction causes the bow-string to be drawn along the fore-end portion towards the butt and into engagement with said releasable catch which then holds the bow-string in the cocked position; characterised in that the hook member is pivotally connected to said linkage and includes guide means which co-operate with a guide track extending along the fore-end portion whereby the hook member is maintained in a substantially unvarying orientation relative to the bow-string as it is drawn towards the releasable catch.

14. A crossbow having a stock substantially as hereinbefore described with reference to and as shown in Figures 1 to 4 of the accompanying drawings.

15. A crossbow having a stock substantially as hereinbefore described with reference to and as shown in Figure 5 of the accompanying drawings.





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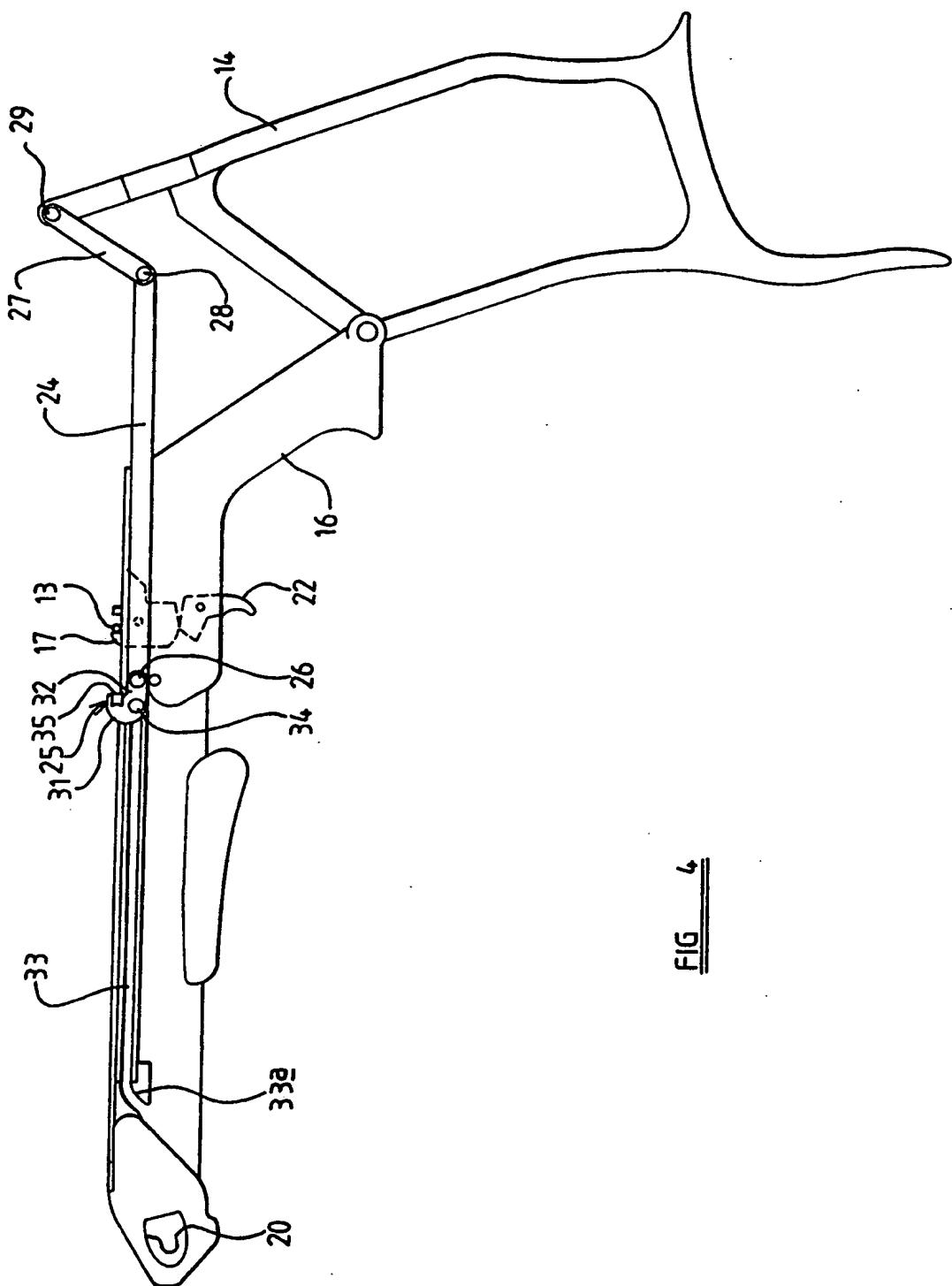
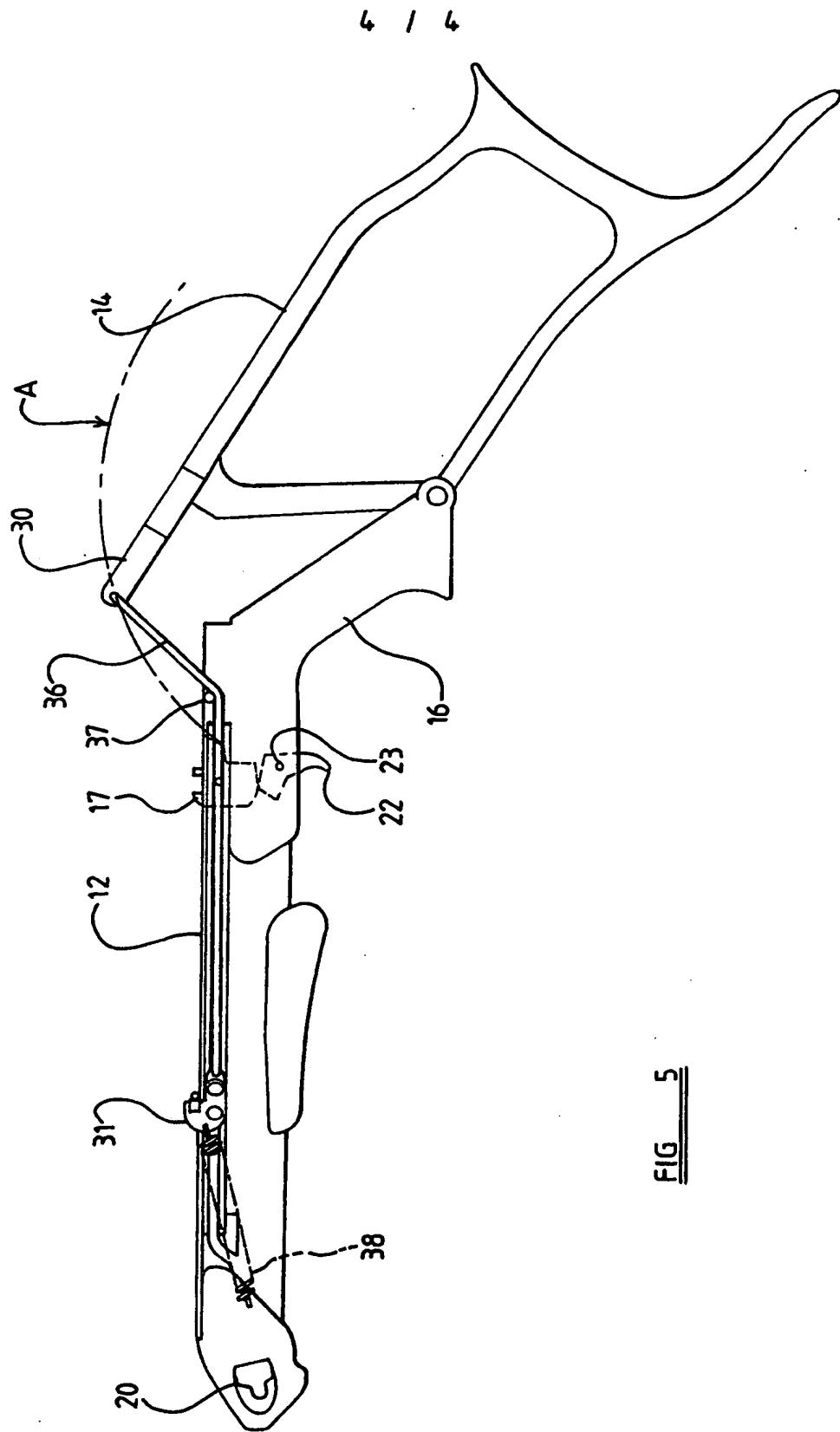


FIG 4



INTERNATIONAL SEARCH REPORT

Date of Application: 10
PCT/GB 00/00185A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F41B5/12

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F41B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 1 553 387 A (BARNETT B T) 26 September 1979 (1979-09-26) cited in the application page 2, line 92 -page 3, line 31; figure 1	1,13
A	US 5 215 069 A (LIU CHA-CHANG) 1 June 1993 (1993-06-01) column 2, line 21-35; figures 1,2 column 2, line 49 -column 3, line 10	1,13
A	US 4 649 892 A (BOZEK JOHN W) 17 March 1987 (1987-03-17)	
A	US 3 043 287 A (R. NELSON) 10 July 1962 (1962-07-10)	
A	US 3 670 711 A (FIRESTONE MAX) 20 June 1972 (1972-06-20)	

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Patent family members are listed in annex.

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Date of mailing of the International search report

6 April 2000

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Intern. Appl. No.

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Patent document cited in search report	Publication date	Patent family member(s)			Publication date
GB 1553387	A 26-09-1979	CA 1083450	A 12-08-1980		
		FR 2373772	A 07-07-1978		
		US 4258689	A 31-03-1981		
US 5215069	A 01-06-1993	NONE			
US 4649892	A 17-03-1987	US 4942861	A 24-07-1990		
US 3043287	A 10-07-1962	NONE			
US 3670711	A 20-06-1972	NONE			